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ABSTRACT

This paper points out that creationists have developed a skill unique to their trade, namely, that of misquotation and quotation out of context from the works of leading evolutionists. This tactic not only frustrates scientists but it misleads school board members, legislators, and the public. A representative sampling of scientists' responses to misquotation and misrepresentation by "scientific" creationists is provided. The scientists responding are: Dr. Richard Lewontin; Dr. Niles Eldredge; Dr. Stephen Jay Gould; Dr. David M. Raup; Dr. Laurie Godfrey; Dr. Isaac Asimov; and Dr. Ashley Montagu. Their comments (which were prepared for this article or excerpted from previously published material) should lay to rest some of the claims that leading "authorities" in science are lending support to antievolutionary arguments or that evolution is no longer accepted by the scientific community. (JN)

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Misquoted Scientists Respond

John R. Cole

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Misquoted Scientists Respond

John R. Cole

> I never cease to be amazed at the skill with which Dr. Morris employs the writings of the top evolutionists themselves to develop an air-tight case against evolution.
>
> —Thomas G. Barnes

Creationists have developed a skill unique to their trade: that of misquotation and quotation out of context from the works of leading evolutionists. This tactic not only frustrates scientists but it misleads school board members, legislators, and the public. Whether such actions by creationists of selectively seeking out quotations or references in order to prove a preconceived case are willful distortion or the product of wishful thinking is irrelevant. Such acts misuse science and scientists in bogus appeals to authority. Creationists seem to be saying, "Don't just take *our* word for it—look at what Professor X has written to prove our case."

To respond to such arguments is difficult for anyone who is not working full time at checking every quotation or tracking down for comment each quoted person. Teachers, parents, policy makers, journalists, and other interested persons are therefore at a disadvantage, and it is for them that this anthology of responses from the scientific community has been compiled. Leading evolutionists in various fields were asked to comment briefly on misinterpretations of their areas of expertise and of their work. Most scientists who were approached replied, although a few cited other commitments that prevented their participation and a couple noted that they could not explain their position in just a few paragraphs.

Half of the following comments were especially written for this article, and the other half are from previously published material, excerpted with the authors' permission. Many topics—and scientists—are not included, but, as an introductory survey of scientists' responses to misquotation and misrepresentation by "scientific" creationists, it is hoped that this anthology will be useful as a representative sampling.

Dr. Richard Lewontin

Author of The Genetic Basis of Evolutionary Change, *biologist at the Museum of Comparative Zoology, Agassiz Museum, Harvard University.*

Dr. Cole is assistant professor of anthropology at the University of Northern Iowa, Cedar Falls.

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Modern expressions of creationism and especially so-called "scientific" creationism are making extensive use of the tactic of selective quotation in order to make it appear that numerous biologists doubt the reality of evolution. The creationists take advantage of the fact that evolutionary biology is a living science containing disagreements about certain *details* of the evolutionary process by taking quotations about such details out of context in an attempt to support the creationists' antievolutionary stand. Sometimes they simply take biologists' descriptions of creationism and then ascribe these views to the biologists themselves! These patently dishonest practices of misquotation give us a right to question even the sincerity of creationists.

Several examples of falsification can be found in a recent issue of *Acts & Facts*, published by the Institute for Creation Research, in an article written by Gary E. Parker, a member of the Institute and a teacher at Christian Heritage College in El Cajon, California. On page two we read that "As Harvard's Richard Lewontin recently summarized it, organisms '. . . appear to have been carefully and artfully designed.' He calls the 'perfection of organisms' both a challenge to Darwinism and, on a more positive note, 'the chief evidence of a Supreme Designer.' "

But the point of my article, "Adaptation" in *Scientific American*, from which these snippets were lifted, was precisely that the "perfection of organisms" is often illusory and that any attempt to describe organisms as perfectly adapted is destined for serious contradictions. Moreover, the *appearance* of careful and artful design was taken *in the nineteenth century before Darwin* as "the chief evidence of a Supreme Designer." The past tense of my article ("It *was* the marvelous fit of organisms to the environment . . . that *was* the chief evidence of 'Supreme Designer' ") has been conveniently dropped by creationist Parker in his attempt to pass off this ancient doctrine as modern science.

Later, on the same page, Parker says that "selection works fine—*if* a species has great genetic variability 'built right into it' by plan, purpose, and special creation." He then tries to support this point of view by quoting a statement of mine which said that selection can change organisms "only if their gene pool contains genetic variation" for the character in question. But it is precisely the *random* nature of the mutation process, the fact that species depend upon chance events in their history to acquire the genetic variation for evolution, that makes a successful response to the pressure of natural selection an uncertain process. Moreover, because populations and families are finite and sometimes quite small in size, mutations that could be selected may be lost to the population before selection has acted to incorporate them. To ascribe the *failure* of adaptation to deliberate design as creationists do is sheer perversity and illustrates why creationism is not science but blind prejudice.

On page four of Parker's paper is another quotation from my article on adaptation, stating that ". . . natural selection over the long run does not seem to

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improve a species's chance of survival but simply enables it to 'track,' or keep up with, the constantly changing environment." This is then alleged to support a conservative rather than a creative role for natural selection—a favorite theme of creationists, who admit minor evolution within species but no major changes. But the theory of environmental tracking (which I think is not a particularly good description of the evolutionary process) does *not* say that the form and function of species is kept constant. What is conserved is the life of the species, but this conservation is made possible by continual change, sometimes quite radical, in the form and function of the organisms as they track an environment that is itself changing in sometimes quite radical ways. Here the creationist has simply played with the meaning of words.

Because of errors and misquotations of this nature, scientists and educators must clear away a great deal of confusion in the public mind about the true nature of evolutionary science. Confusion that wouldn't be there if it hadn't been created by creationists.

Dr. Niles Eldredge

Curator, Department of Invertebrates, American Museum of Natural History, and coauthor with Stephen Jay Gould of the papers on the theory of punctuated equilibria that initiated the past decade's revolution in paleontology and evolutionary theory.

It is particularly galling to one who labors in the vineyards of evolutionary biology to hear a candidate for the presidency of the United States declare, when asked about evolution, "Well, it is a theory, it is a scientific theory only, and it has in recent years been challenged in the world of science and is not yet believed in the scientific community to be as infallible as it once was believed." Nonsense. No active geneticist, embryologist, systematist, anatomist, or paleontologist doubts that life has evolved. What such biologists *do* argue about is *how* life has evolved.

All science involves the search for better explanations. We are currently entering a period of renewed intensity in our search to understand the mechanisms of the evolutionary process. For the past forty years or so, evolutionary thinking has been dominated by a single, simple, and rather elegant notion: that natural selection, tracking environmental change, modifies organisms' adaptations. The "synthetic theory of evolution" claims that this process accounts for all of evolutionary history. Still the dominant view held today, this synthesis marks an unusual period of virtual agreement within the entire field of biology. Many biologists in different disciplines are now openly skeptical that adaptation via natural selection alone can really account for all aspects of the evolution of life's diver-

sity. Scientists see this as a healthy sign; debates over the relative merits of conflicting ideas are the heart and soul of science. Creationists, taking the synthetic theory as a synonym of "evolution," conclude from the debates that biologists are no longer wholeheartedly sure that life has evolved. Hence Ronald Reagan's remark.

As an example, the notion of "punctuated equilibria," which Stephen Jay Gould and I began discussing in the early 1970s, is commonly cited in creationist literature as evidence that evolution has *not* occurred. Among other things, the notion of punctuated equilibria accounts for the *lack* of change seen in most fossil species as they persist through, in some cases, several millions of years. We questioned the long-held belief that evolutionary change must be slow, steady, gradual, and inevitable—a view that goes back to Darwin himself. We claimed, instead, that evolution preceeds by fits and starts, mostly in conjunction with events surrounding the origin of new species. Creationists argue that, inasmuch as fossil species do not change much once they appear, the very notion of evolution is itself falsified. But Gould and I were only doing what scientists always do: testing predictions against real evidence. We found that the evidence failed to support the notion that evolutionary change in general is slow and gradual. We then offered an alternative explanation that, for the moment, seems to us to fit the evidence better. We never concluded that life did not evolve, but merely that it did not evolve exactly the way that Darwin said it did. Our data agree perfectly with the general notion that life *has* evolved.

There are today but two explanations of the pattern similarity interconnecting all forms of life: all organisms share RNA and all vertebrates share backbones and other structures. All mammals have three inner ear bones and mammary glands. How do you explain this pattern of nested similarities? The creationists see this pattern and explain it as the manifestation of a supernatural creator's blueprint. Biologists see the pattern and note that "descent with modification" would also yield the same patterns. How do we choose between these two explanations of the same evidence?

Biologists say that, *if* evolution has occurred, there should follow some predictions about living creatures. I'll give two of the several general consequences of the notion of evolution. First, we would predict that there must be one (not several or many) single, coherent pattern of similarity linking all forms of life together. This prediction is tested daily by systematists seeking to classify the ten million or so fossil and living species. They predict that distributions of anatomical and behavioral features should yield one single pattern. And this is what they find: one single pattern.

Here is another general prediction from the basic notion of evolution: if evolution has occurred, there should be a regular change in the appearance of life as one goes further back in the fossil record. Progressively earlier forms within a group (for example, the horse family) should look more and more like the early

representatives of other closely related groups. They do. The Eocene "dawn horse" looks far more like an Eocene rhinoceros than it resembles a modern race horse. And so on. Predictions about laboratory changes in gene frequencies and patterns of differentiation leading to new species is testable and has survived all serious attempts to refute it.

Creationists, on the other hand, make no predictions about patterns of nature that *must* be there *if* all of life was fashioned separately by a creator. They cannot. It is their position that whatever patterns we see, that's what the creator made. Thus, there is no way they or anyone else can test creationist notions by consulting nature. One must take creationism on faith alone. "Scientific" creationists purport to test (and always refute!) hypotheses from geology and biology —never hypotheses drawn directly from creationism as a part of science. Yet these same creationists later say that neither creation nor evolution belongs in the realm of science. Both positions are wrong. Evolutionary biology is as much a part of science as nuclear physics; creationism is not a part of science at all.

Thus, the choice boils down to a preference for human understanding of the universe through that unique interplay of thought and experience we call *science* versus an acceptance of authoritarian revealed truth. Evolution and creationism both explain life's diversity, but only evolution belongs in a science curriculum.

Dr. Stephen Jay Gould

Professor of geology, Harvard University; author of The Panda's Thumb; *and probably the single most misquoted and misused scientist among the creationists' unwilling allies. This exerpt is from "Evolution as Fact and Theory,"* Discover, *May 1981.*

It is infuriating to be quoted again and again by creationists—whether through design or stupidity, I do not know—as admitting that the fossil record includes no transitional forms. Transitional forms are generally lacking at the species level but are abundant between larger groups. The evolution from reptiles to mammals . . . is well documented. Yet a pamphlet entitled "Harvard Scientists Agree Evolution Is a Hoax" states: "The facts of punctuated equilibrium, which Gould and Eldredge . . . are forcing Darwinists to swallow fit the picture that [William Jennings] Bryan insisted on and which God has revealed to us in the Bible."

Dr. David M. Raup

Dean of Science, Field Museum of Natural History in Chicago; "punctuationalist" whose writings, along with those of Gould and Eldredge, are among the most

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influential contributions to that theory and among those cited by creationists in an attempt to bolster their case.

One of the most unfortunate aspects of the current creation-evolution debate is that many of the creationists equate Darwinian theory with evolution. They are saying, in effect, that if Darwin's theory falls, then so does evolution. Nothing could be further from the truth. To me, there are two basic questions: Has evolution occurred (in the sense of change in the biological composition of the earth over millions of years)? By what mechanisms has evolution occurred? Darwin's contribution was to the second question. He proposed a biological mechanism: natural selection. Whether Darwin was right or wrong has no bearing on the question of whether evolution did or did not occur.

On the question of whether or not evolution has occurred, I would say that there are few things in the natural sciences about which we can be more confident. The geologic time scale has been checked and rechecked by many independent methods. Although individual dates may be subject to error, the overall chronology stands firm. It is used every day in petroleum and mineral exploration, and, if there were basic problems with it, I am sure that industrial geologists would have blown the whistle. The fossil record is intimately tied in with this chronology and shows a record of change in organisms through time. What we are not sure about is just how the biological changes took place. Natural selection surely played a part, but there may be other biological processes that have operated. One of the challenges of biology and paleontology is to find out what other processes were involved.

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Dr. Laurie Godfrey

Assistant professor of anthropology, University of Massachusetts at Amherst, and editor of two forthcoming books, A Century After Darwin *and* Scientists Confront Creationism. *As a specialist in human and primate evolution, she is particularly concerned with creationist misrepresentations of the literature on human evolution.*

On April 10, 1981, creationist Dr. Allen Beeber presented a slide show and lecture on scientific creationism at the University of Massachusetts. Although it was ill-received (largely because of its inadequate science), it is worth notice because it illustrates so well the techniques of creationists.

Beeber's doctorate in polymer science seemed impressive at first, but it turned out that there was no polymer science in his presentation. Indeed, Beeber had neither assembled the slide show nor written much of the text. The source of his slide show was John Baungardner of Canoga Park, California. It was a

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"learned" presentation and, judging from the misuse of data in anthropology, geology, biology, physics, and mathematics, it was clear that the author or authors lacked familiarity with much of the material cited. This was certainly true of Beeber, who admitted not having read sources quoted in his arguments.

Distorting information in my own field, Beeber led the audience to believe that *Australopithecus* was probably, according to anthropologist Charles Oxnard, some kind of orangutan (or, at least, *like* an orangutan), that anthropologist Clifford Jolly had demonstrated that fragmentary *Ramapithecus* was probably some kind of baboon, and that Richard Leakey had shown that ER 1470 was essentially a modern human.

These are standard creationist arguments, mirrored, for example, by Dr. Gish in his book, *Evolution: The Fossils Say NO!* Gish argues on page 103 that Clifford Jolly uncovered "devastating evidence against the assumption of a hominid status for *Ramapithecus*" and that *Ramapithecus* was at best a monkey-like ape or, perhaps, a "monkey with diet and habitat similar to that of galada [sic] baboons." He quotes Charles Oxnard as saying that *Australopithecus* was a unique form but, "to the extent that resemblances exist with living forms, they tend to be with the orangutan." Gish adds, ¿'Oxnard's conclusions are that *Australopithecus* is not related to anything living today—man or ape—but was uniquely different" (p. 12). Gish asserts that modern *Homo* was around all along, stating that Richard Leakey has found a skull of an individual contemporaneous with *Australopithecus* (ER 1470), which is "almost indistinguishable from those of many individuals living today" (p. 136).

This represents a gross distortion of what Jolly, Oxnard, and Leakey actually said. Jolly cited dental parallelism between the baboon *Theropithecus gelada* (which feeds on small hard objects such as grass corms and seeds) and early hominids in an attempt to reconstruct the diet of the extinct forms. But neither Jolly nor any anatomist would ever confuse the mouth of a baboon with that of a hominid such as *Ramapithecus* (nor any other fossil genus with small front teeth and large cheek teeth, such as the lemur *Hadropithecus* or hominid *Australopithecus*). Nowhere did Jolly even remotely imply that *Ramapithecus*, *Australopithecus*, *Hadropithecus*, or *Homo* are baboons.

Oxnard similarly never implied that *Australopithecus* is unrelated to any animal living today. Instead, Oxnard argued that late Pliocene and early Pleistocene *Australopithecus* was not directly ancestral to *Homo erectus* but shared a more remote common ancestor with an earlier variant of the genus *Homo*. He further argued that *Australopithecus*, while facultatively bipedal, probably engaged in climbing activities as well. His research question was functional: Was *Australopithecus* a habitual bipedal? His analysis was based entirely on some postcranial fragments. Oxnard readily acknowledged the shared dental and cranial features of *Australopithecus* and *Homo* (signs of their common ancestry). He merely argued that the postcranial resemblances of *Australopithecus* to orangu-

tans imply functional similarities, not a closer relationship of *Australopithecus* to *Pongo* (the orang) than to *Homo*.

In conclusion, Gish's allegations concerning ER 1470 are a bit mysterious, since ER 1470 has a face similar to that of robust australopithecines and a cranial capacity little more than half that of the average modern human. The creationist slide showed it in front view, not profile, probably because in profile this "strikingly modern" skull looks far more like other specimens of early *Homo* and *Australopithecus*. Leakey describes ER 1470 as a member of the lineage (*Homo habilis*) ancestral to *Homo erectus*, in turn ancestral to *Homo sapiens* (modern man). Some of the hooplah surrounding the discovery of ER 1470 was based on the unexpected presence of a 2.5 million-year-old hominid with a cranial capacity fo 800 cc. Leakey publicized the great antiquity of his relatively large-brained discovery with great showmanship. The redating of ER 1470 at less than two million years makes this find far less remarkable than originally hailed. In any case, Leakey never considered it a member of the modern human race.

In spite of these facts, Beeber used this skimpy creationist "review" of the hominid fossil record, plus the well-known Piltdown hoax and the pig tooth once briefly mistaken for that of a hominid ("Nebraska man"), in an attempt to destroy the credibility of the human fossil record. Such arguments have worked well on audiences unfamiliar with the data, but they did not succeed at the University of Massachusetts.

Dr. Isaac Asimov

Author of 232 books and professor of biochemistry at Boston University School of Medicine. His popular writings which explain the workings of the second law of thermodynamics have been widely quoted from by creationists. This response is excerpted from "The Threat of Creationism," which appeared in the June 14, 1981, issue of New York Times Magazine, *and reprinted with permission.*

Creationists, in recent years, have stressed the "scientific" background of their beliefs. They point out that there are scientists who base their creationist beliefs on a careful study of geology, paleontology, and biology and produce "textbooks" that embody those beliefs.

They have learned enough scientific terminology to use it in their attempts to disprove evolution. They do this in numerous ways, but the most common example, at least in the mail I receive, is the repeated assertion that the second law of thermodynamics demonstrates the evolutionary process to be impossible.

In kindergarten terms, the second law of thermodynamics says that all spontaneous change is in the direction of increasing disorder—that is, in a "downhill" direction. There can be no spontaneous buildup in the complex from the simple,

because that would be moving "uphill." According to the creationist argument, since, by the evolutionary process, complex forms of life evolve from simple forms, that process defies the second law, so creationism must be true.

To lift the argument a notch above the kindergarten level, the second law of thermodynamics applies to a "closed system"—that is, to a system that does not gain energy from without, or lose energy to the outside. The only truly closed system we know of is the universe as a whole.

Within a closed system, there are subsystems that can gain complexity spontaneously, provided there is a greater loss of complexity in another interlocking subsystem. The overall change then is a complexity loss in line with the dictates of the second law.

Evolution can proceed and build up the complex from the simple, thus moving uphill, without violating the second law, as long as another interlocking part of the system—the sun, which delivers energy to the earth continually—moves downhill (as it does) at a much faster rate than evolution moves uphill.

Unfortunately, the second law is a subtle concept that most people are not accustomed to dealing with, and it is not easy to see the fallacy in the creationist distortion.

Dr. Ashley Montagu

Physical anthropologist at Princeton University and renowned author. He summarizes below the attitude of the scientific community toward the general theory of evolution.

Regarding the recent action brought by the creationists in California and the judge's order that the state distribute more copies of a statement of long-standing policy that evolution should not be taught as dogmatic, irrefutable fact but rather as a scientific theory, the truth is that evolution is an unrefuted fact. There are theories concerning the exact mechanisms of evolution, but concerning evolution there no longer can be any doubt as to its reality.

The method of science is falsification, the attempts to disprove by every possible means the theory which appears to explain the fact. If the attempt fails, the scientist knows that he has something and proceeds to set up experiments to further test the theory. When the results support the theory, they are published so that other scientists can check them. When the findings are verified, we have "irrefutable" proof of the accuracy of the theory. In that sense, truth for a scientist means the highest degree of probability attached to a particular judgment.

In that same sense, because we have innumerable evidences of the reality of evolution, both of a premeditated and unpremeditated (natural) experimental kind, evolution is no longer a theory but one of the best authenticated facts within

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the whole realm of science. The fact of evolution is beyond dispute.

Theories as to the exact mechanisms of evolution are (happily) alive and being debated—such debate constitutes the lifeblood of science, not evidence of disagreement as to the fact of evolution. The scientist believes in proof without certainty; some other people believe in certainty without proof.

Not all things can be proven; evolution can. Creation myths are just that: myths. As such, they are the legitimate study of anthropologists and folklorists. If some people choose to believe them to be truths, they are free to do so.

Conclusion

The foregoing statements should lay to rest some of the claims that leading "authorities" in science are lending support to antievolutionary arguments or that evolution is no longer accepted by the scientific community. There is no "club secret" that evolution is "bankrupt" or that the theory is "crumbling," as many creationists have charged.

It is easy to see how, with effort and a single-minded search through scientific literature, one can locate sentences and passages in anyone's work that can be interpreted out of context to mean whatever one desires. By this same method, some people read into the Bible proof that "ancient astronauts" visited earth.

Instead of searching for quotations, creationists should test their ideas against empirical evidence. The results of such tests, if carefully performed, can then be submitted to the peer review of the scientific journals. Scientists reading the results can duplicate the experiments or recheck the data. If they disagree, their positions will also appear in the journals. Scientists normally disagree with and test each other's ideas. This is the nature of science. But when the Moral Majority's Jerry Falwell promises that students at his Liberty Baptist College will never find differences of opinion among faculty members and that "anytime they start teaching something we don't like, we cut the money off" (Fitzgerald), he promises the opposite of science.

Still, it is easy to see how anyone wedded to such a dogmatic view would find the dynamics of scientific argument and counter argument a kind of proof that scientists now dispute evolution. Absolutist searchers for chinks in the evolutionists' armor miss the point of science and project their either-or values onto it. They therefore see certain scientists as "authorities" who can be used to champion their views.

Arguments from authority are logically weak. A position does not stand or fall depending upon who endorses it. It is the evidence and its logical interpretation that tell the tale. Even if creationists quote an individual more or less correctly, this does not support their position.

One example, in particular, of near-correct quotation involves philosopher

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Sir Karl Popper. In 1976 Popper said, "Darwinism is not a testable scientific theory but a metaphysical research program." But Popper is not an expert in the biological sciences or their history. Furthermore, he is not the only philosopher of science in the world with anything to say on the subject of evolution. Philosophers often disagree with each other more than scientists do. And, to top it off, Popper has recently changed his mind on his earlier pronouncement against evolution. In 1978 he wrote, "I have changed my mind about the testability and logical status of the theory of natural selection, and I am glad to have the opportunity to make a recantation." Popper, much earlier than 1976, had had even stronger criticisms of evolution. But as early as 1972 he wrote:

> I blush when I have to make this confession; for when I was younger, I used to say very contemptuous things about evolutionary philosophies. When twenty-two years ago Canon Charles E. Raven, in his *Science, Religion, and the Future*, described the Darwinian controversy as "a storm in a Victorian teacup," I agreed, but criticized him for paying too much attention "to the vapors still emerging from the cup," by which I meant the hot air of the evolutionary philosophies (especially those which told us that there were inexorable laws of evolution). But now I have to confess that this cup of tea has become, after all, *my* cup of tea; and with it I have to eat humble pie.

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Popper then proceded to restate Darwin's theory in a manner that was logically consistent, feeling that Darwin and other evolutionists had not done the best job nor used the right words to express the theory.

We can see, then, that not only is disagreement between scientists a natural part of the scientific enterprise but scientists and philosophers are capable of changing their minds. Creationism, on the other hand, tries to be the same "yesterday, today, and forever." It is therefore not a science, and citations, quotations, and details lifted out of context do not magically make it so.

Bibliography

Barnes, Thomas G. 1975. Foreward in *The Troubled Waters of Evolution* by Henry Morris. San Diego: Creation-Life Publishers.

Fitzgerald, Frances. May 18, 1981. "A Disciplined Changing Arms." *New Yorker*, pp. 53-141.

Gish, Duane T. 1973. *Evolution: The Fossils Say No!* San Diego: Creation-Life Publishers.

Lewontin, Richard. 1978. "Adaptation." *Scientific American*. 239:3:212-230.

Parker, Gary E. October 1980. "Creation, Selection, and Variation." *Acts & Facts*. Impact No. 88.

Popper, Karl R. 1972. *Objective Knowledge, An Evolutionary Approach*. Oxford: Clarendon Press, p. 241.

———. 1963. *Conjectures and Refutations*. New York: Basic Books, p. 257.

———. 1978. "Natural Selection and the Emergence of Mind." *Dialectica*. 32:399 ff.